

LIMITED CIRCULATION

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AGRICULTURAL MEMORANDUM NO 1057

Trouble shooting in an Egg Storage Room

By C P Roe

SUMMARY

A Broiler Chick Hatchery in Powys has experienced chick quality problems over a long period of time. All possible factors affecting hatchability and chick quality are being investigated by ADAS and the hatchery management. As part of this exercise ADAS Agro-meteorologists were called in to monitor temperature and humidity conditions within the egg store at the hatchery. The measurements taken indicated that temperature and humidity control were inadequate and needed to be improved.

This paper describes how the problem was isolated using sophisticated data-logging equipment, what remedial action was taken and finally, what improvement resulted. The work highlights the potential of modern data-logging equipment in advisory studies.

1. INTRODUCTION

Egg storage is a necessary part of commercial incubation. Two factors are crucial to embryonic survival for even short periods of storage: these are environmental temperature and relative humidity.

These parameters had been recorded some years ago at the Broiler Chick Hatchery in question which had experienced chick quality problems and were found to be satisfactory. The equipment used at the time was relatively crude and unsophisticated and as the problems persisted there was a need for a repeat study using more sophisticated equipment.

The target parameters are a temperature of 13-16°C at 75% relative humidity for eggs being held for 4-7 days (ADAS, 1982). A steady temperature is desirable to avoid stress on an embryo which at this stage is likely to consist of about 60,000 cells. Relative humidity is maintained at a level sufficient to minimise evaporative water loss from the eggs through the pores of the shell. At the same time, it is essential to avoid condensation on the eggs which can promote bacterial growth. This will occur if temperatures fluctuate widely without a corresponding adjustment in humidity.

2. IDENTIFYING THE PROBLEM

A two-week study was initiated to determine temperature and relative humidity distributions within the egg storage room. Two weeks of very different weather patterns were encountered. The first week, May 31-June 6, 1985, was dominated by high pressure with high daytime maxima and comparatively low nighttime minima. The second week was unsettled with less marked diurnal fluctuations.

2.1 Temperature analysis

A grants 'Squirrel' SQ8-4U data-logger was installed to measure air temperature at 4 locations at 15 minute intervals. The layout of the probes^{is} shown in Figure 1.

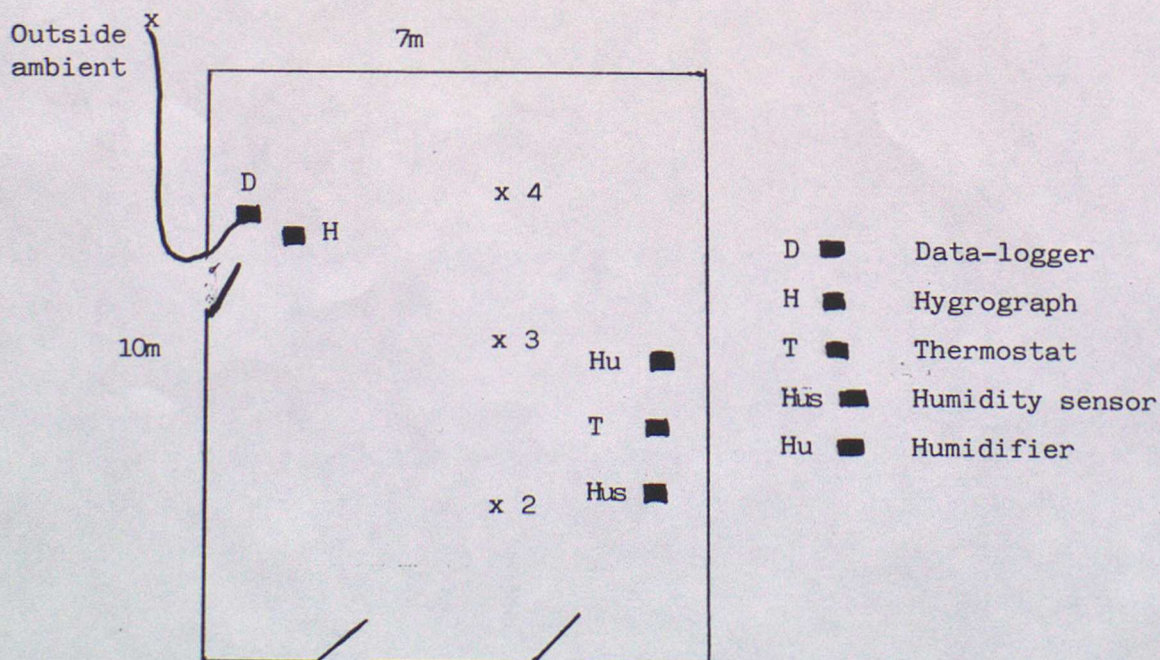


Figure 1.

Each probe indoors was exposed at 2 metres above ground and approximately 6" above the top of the egg trays. Probe 1 was exposed in a 'cocoa-tin' mount shaded from the sun to measure outside ambient temperatures.

Figures A1, A2* show temperature profiles for weeks one and two outside and at 3 locations in the egg store. The cutting-in of the heaters overnight is clearly visible, as are the high afternoon temperatures associated with the egg store doors being left open whilst eggs are being moved into and out of the store. Table 1 gives the statistical analysis.

Table 1.
Temperature analysis at hatchery.

Week 1: May 30 - June 6 am; Week 2: June 6 pm - June 13

Channel	Week 1				Week 2			
	Max	Min	Mean	Stan.Dev.	Max	Min	Mean	Stan.Dev.
1	26.0	2.6	15.8	6.0	16.8	2.6	11.4	3.0
2	19.2	11.8	14.8	1.2	15.2	11.0	12.4	0.4
3	17.4	11.8	14.2	1.0	13.4	10.6	12.0	0.4
4	17.2	10.8	14.4	1.2	13.2	9.6	11.6	0.6

In week 1, egg store temperatures remained mostly within the prescribed optimum of 13-16°C but in week 2 temperatures fell below the required minimum. The location of the thermostat, mounted flush against an iron girder on a sidewall, 3 m above ground was not ideal and it was felt that temperature control in the store could be improved by relocating the sensor.

* Graphs drawn with Epson HX20 microcomputer and Grants software.

2.2 Humidity analysis

Relative humidity (RH) was recorded with a hygrograph c/w weekly clock mounted on a chair adjacent to the data-logger (see Figure 1). Figure A3 shows the RH traces for both weeks. The main cause for concern was the variability of RH, between 53 and 90% with a mean of 75%. low humidities coincided with the overnight action of the heaters, and indicate that the humidifier is not, or is incapable of, doing its job in allowing prolonged periods of low RH. The humidity sensor was located next to the thermostat and it was felt that relocating it in a more central position would improve response. The existing humidifier cannot adequately compensate for the large falls in RH induced by a temperature rise of up to 5 or 6°C, indicating the need for an additional humidifier.

3. REMEDIAL ACTION

Temperatures and relative humidities differed from optimum values by substantial amounts on occasions, indicating a need for improved control. Management at the hatchery was advised that better control could be effected by:

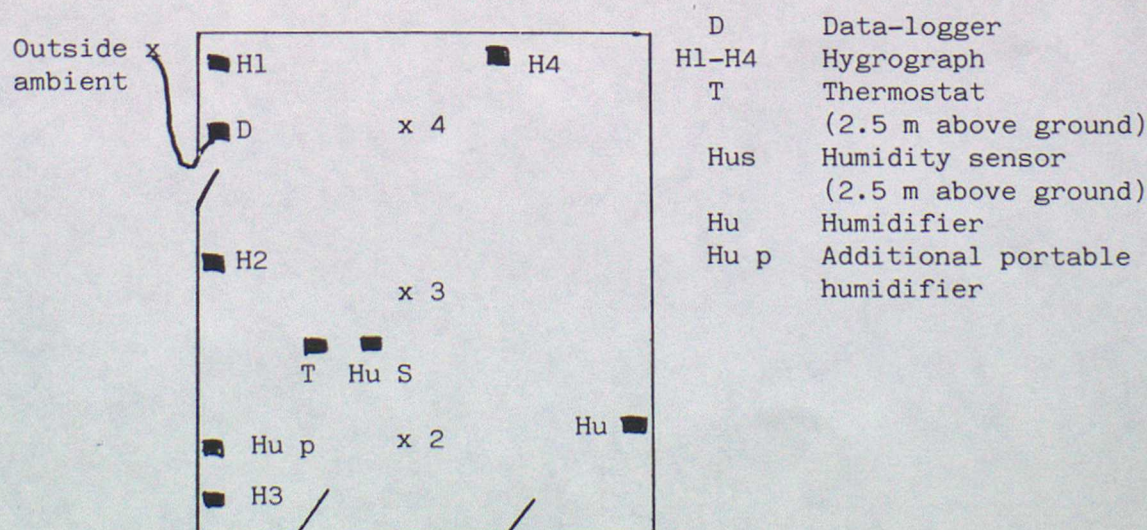
- i relocating the thermostat and humidity sensors in a more open and central position
- ii increase humidity control by installing an additional humidifier.

Hatchery technicians quickly implemented these recommendations prior to a repeat study of the egg-store environment.

4. FOLLOW-UP VISIT TO STUDY EFFECTS OF REMEDIAL ACTION.

Temperature and relative humidity were monitored for a one week period from 19-26 July, 1985. The location of temperature probes and hygrographs are shown in Figure 2.

Figure 2



Additional hygrographs, 4 in all, were installed to enable a more detailed study of the variability of relative humidity within the room to be ascertained. Their positioning is far from ideal for this purpose but was dictated by movements of the egg storage trolleys in and out of the store. Each hygrograph was mounted on a chair.

4.1 Temperature analysis

Figures Bla*, Blb* and Blc* show temperature profiles at probes 2, 3 and 4 respectively over the study period; outside ambient temperatures are superimposed on these graphs to emphasize the effect of the heaters cutting-in. Table 2 gives the statistical analysis for each probe.

Table 2
Temperature (°C) analysis at Churchstoke, July 19-26

Channel	Max	Min	Mean	Stan. Dev.
1	27.4	6.4	16.2	4.2
2	18.6	10.8	13.6	1.4
3	16.6	10.8	13.2	1.0
4	17.0	10.6	13.2	1.0

Temperature fluctuations are contained within the range of 12-16°C for most of the time. Although this is slightly larger than the specified optimum⁴ of 13-16°C, Poultry Husbandry specialists suggest that this deviation should not give cause for concern.

4.2 Humidity analysis

The main improvement from the remedial action is reflected in relative humidity. Traces from each hygrograph are shown in Figure B2. It can be seen from the chart for H1 (in the same location as in the original study) that low overnight humidities are not so pronounced as before, dropping to around 70% instead of the low fifties (eg on 1 June). Mean RH for the week was 82% with a range of 66-90%. This exceeds the optimum of 75% but it is thought better to have slightly higher humidities to prevent egg dehydration provided that condensation does not occur. With humidities

* Graphs drawn with BBC micro-computer ~~and~~ Grants software.

not exceeding 90%, it is very unlikely that condensation would ever have occurred but of course a more complete picture of the temperature profile could only be built up by taking measurements in the vertical as well as the horizontal plane.

Figure B2 shows almost identicle traces on each hygrograph indicating that humidity is fairly uniform throughout the store at instrument level.

5. CONCLUSIONS

A preliminary study of temperature and humidity conditions in a commercial Broiler Chick Hatchery revealed poor control as a result of poorly positioned sensors and insufficient humidifier capacity. It is likely that the poor egg store environment contributed to the problems experienced by the hatchery.

Relocating the sensors and installing an additional humidifier effected better control although conditions could not be considered ideal.

This work highlights the importance of an Agro-meteorological input in advisory studies of this type where sophisticated data-loggers can detail short term temperature fluctuations wherever appropriate.

6. ACKNOWLEDGEMENTS

The assistance provided by Dr J Starr, Agro-meteorological Officer for Wales and the information provided by Mr R King, Regional Poultry Husbandry Adviser, ADAS, Ruthin is gratefully acknowledged.

7. REFERENCE

ADAS	1982	Hatching egg storage on the farm. Leaflet 804.
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Any comments or suggestions on this paper should be sent to the author.

KEY WORDS

EGG STORAGE/ENVIRONMENTAL
CONDITIONS/DATA LOGGERS

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19 August 1985

FIG A1

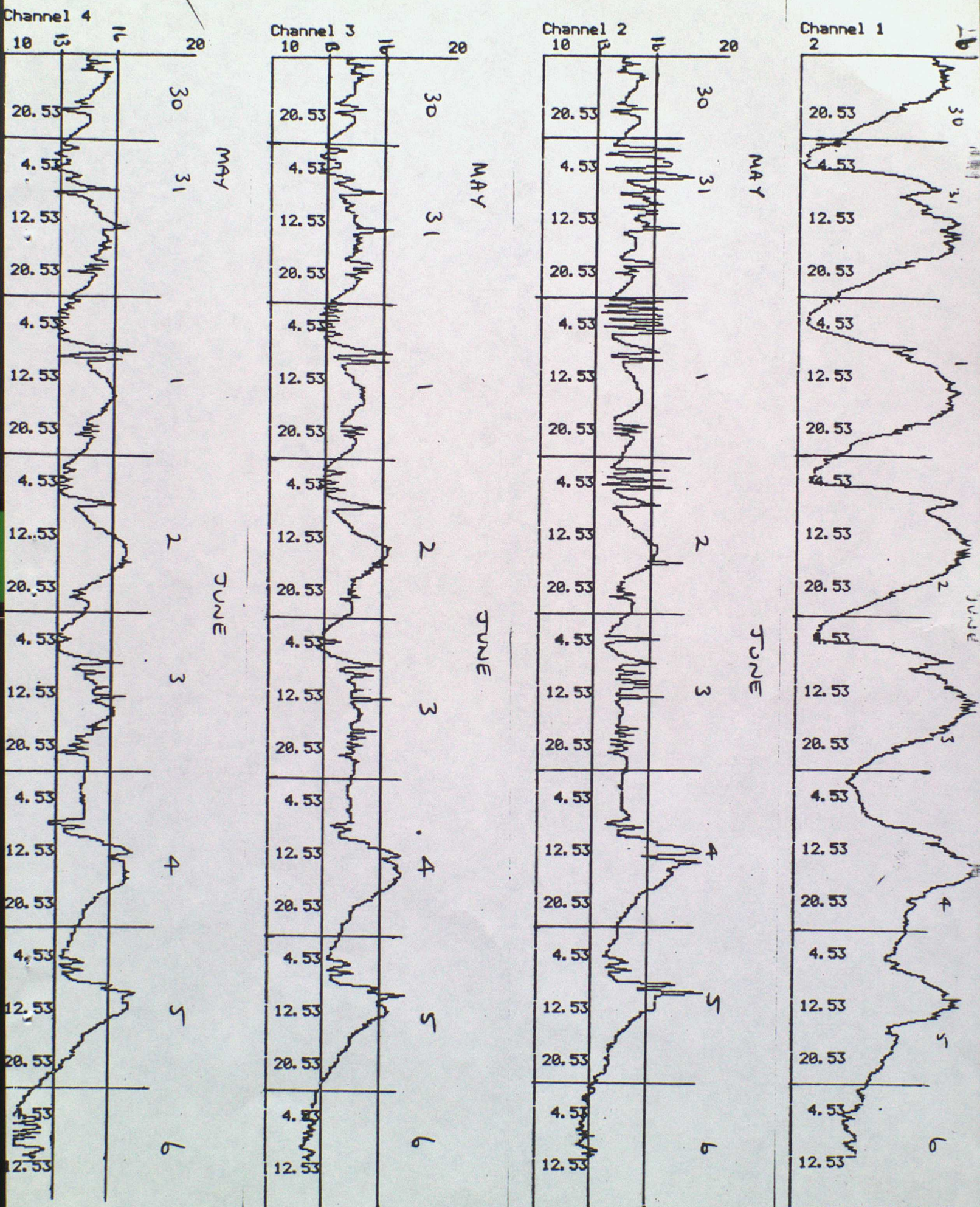
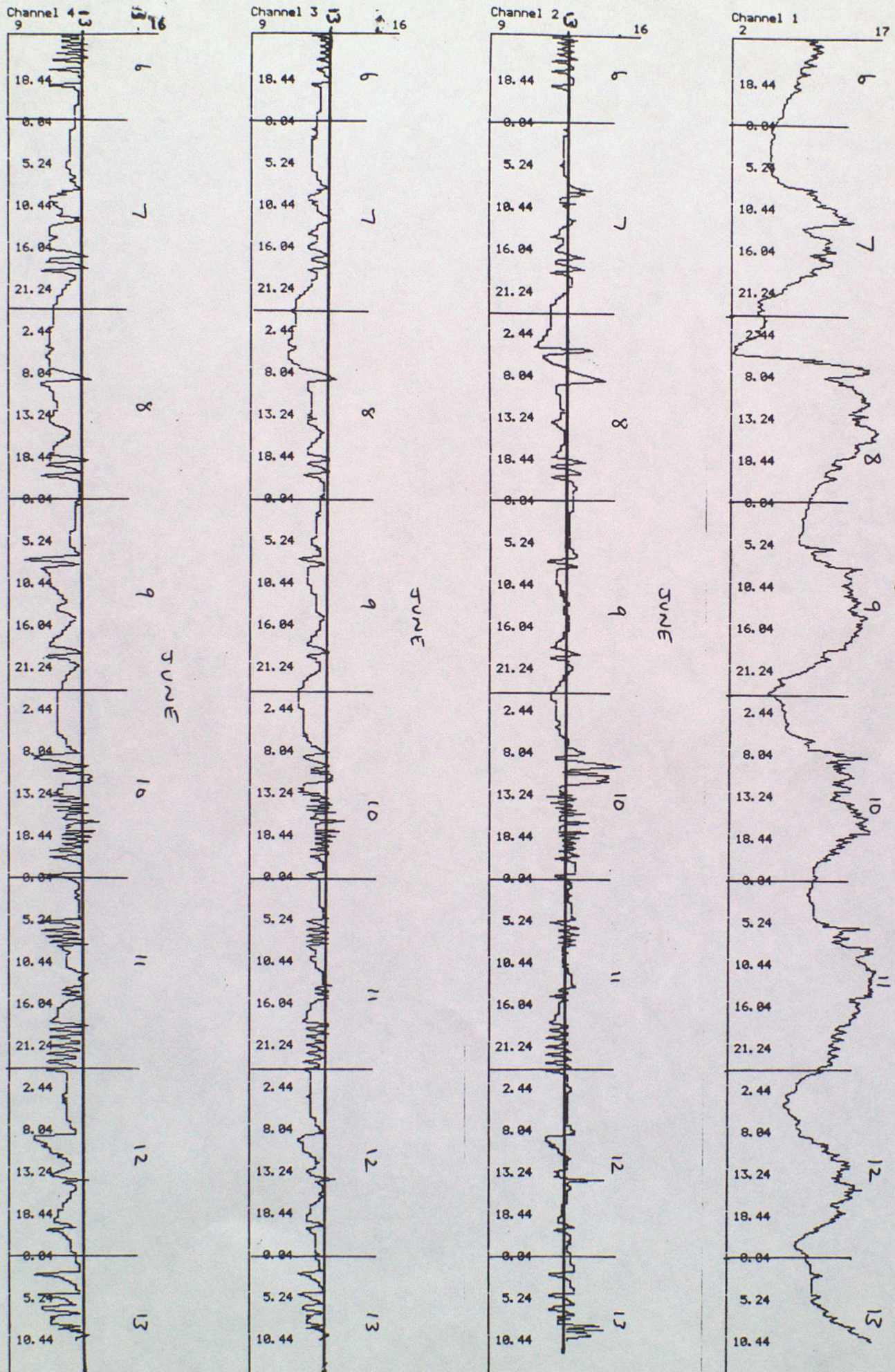


FIG A2



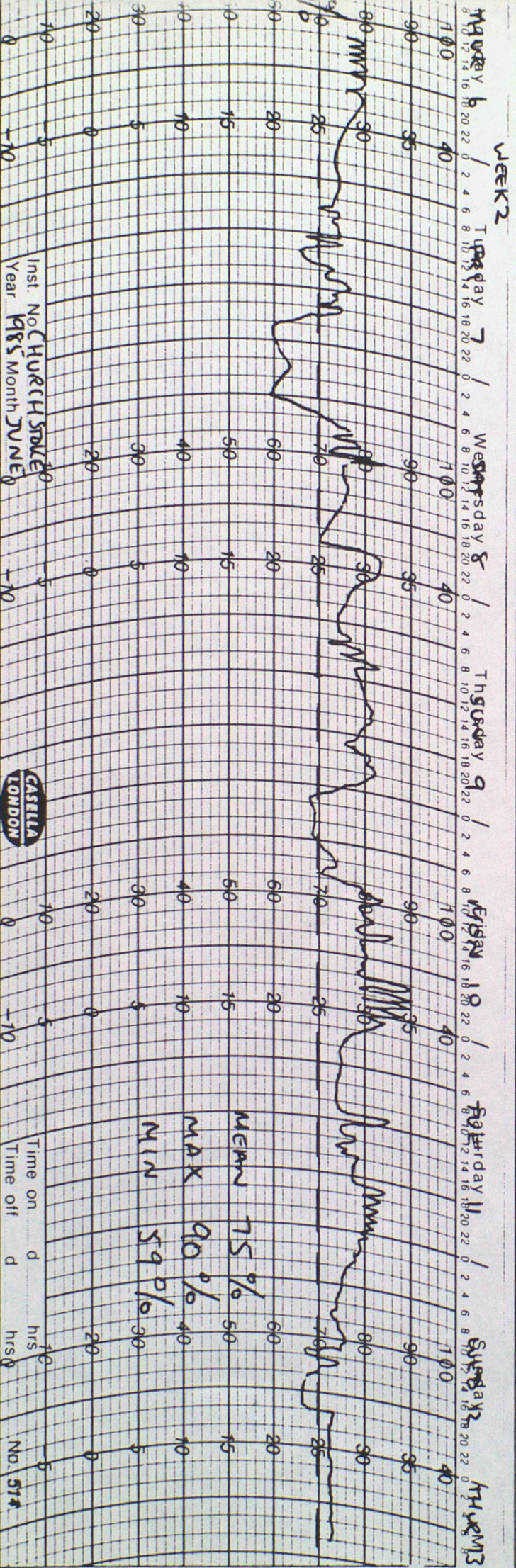
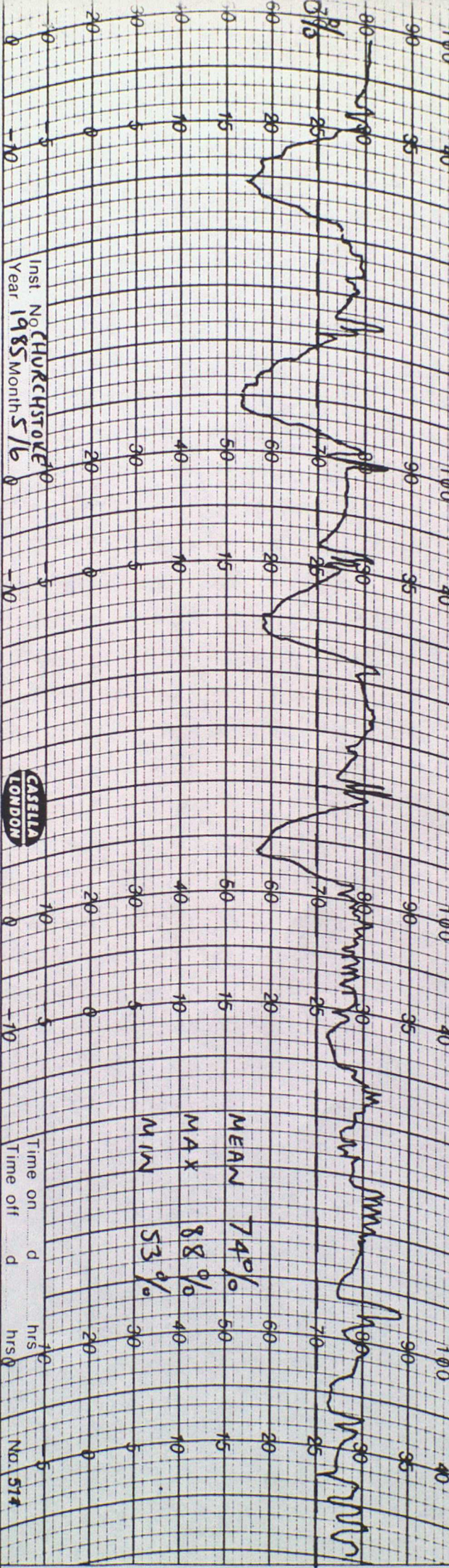


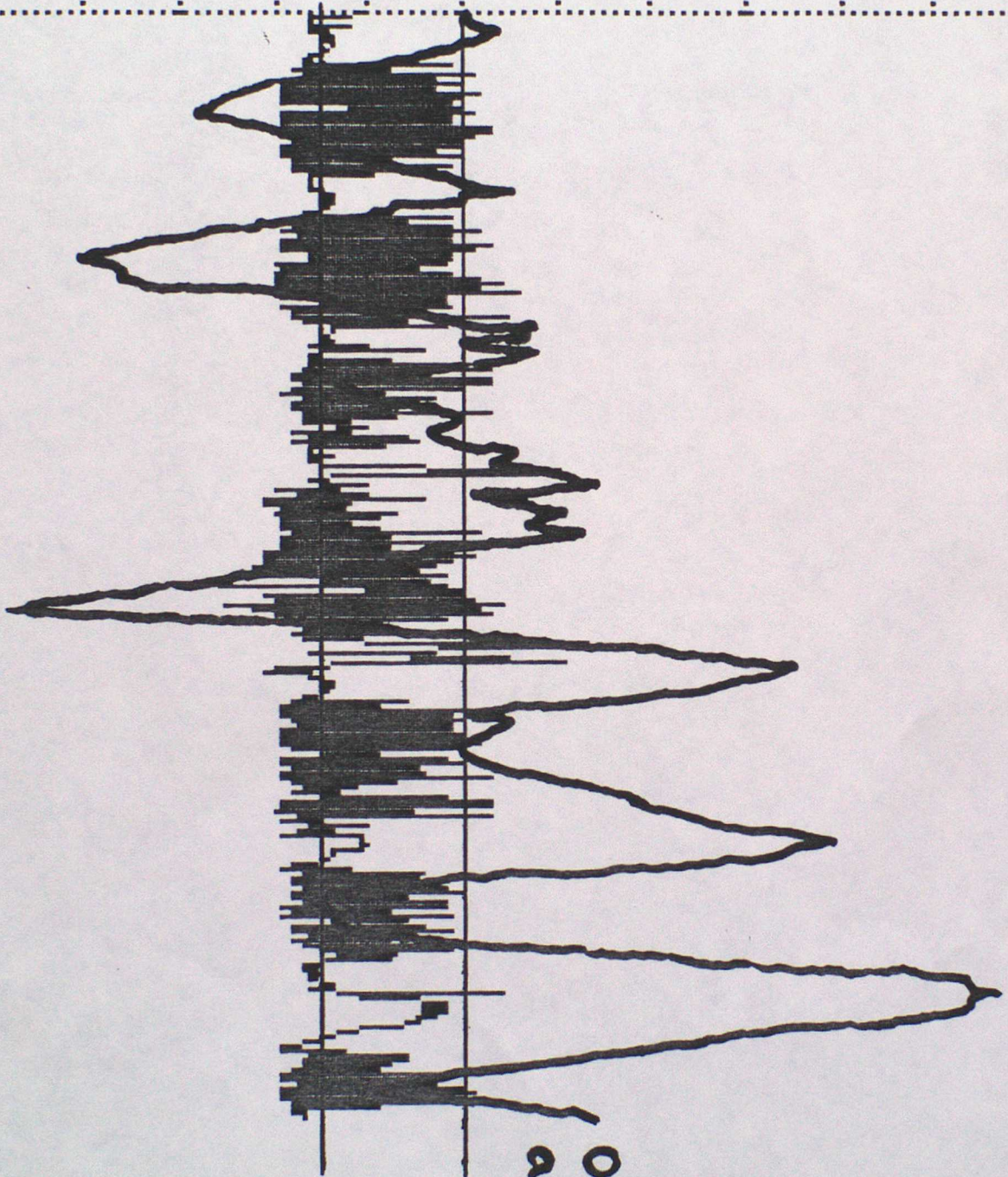
Fig B1a

CH2/C

CHSTOKE
Probe 2

30
28
26
24
22
20
18
16
14
12
10
8
6

α



Outside
ambient

20-JUL-85

26-JUL-85

0:00/00

0:00/00

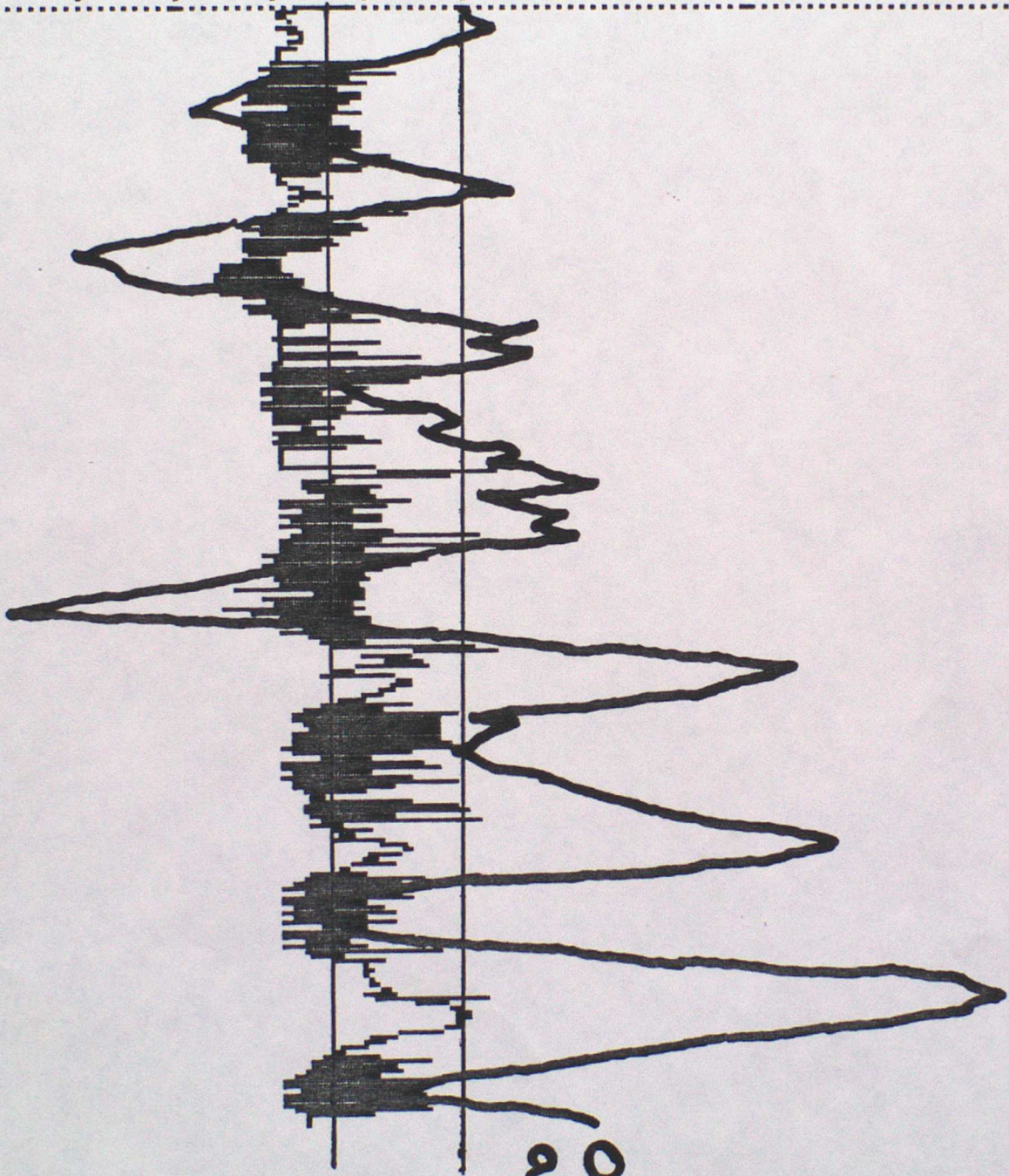
Fig B1 b

CH3'C

CHSTOKE
Probe 3

°C

30
28
26
24
22
20
18
16
14
12
10
8
6



Outside
ambient

20-JUL-85
0:00/00

26-JUL-85
0:00/00

CH4'C

CHSTOKE

Probe 4

Fig Bl c

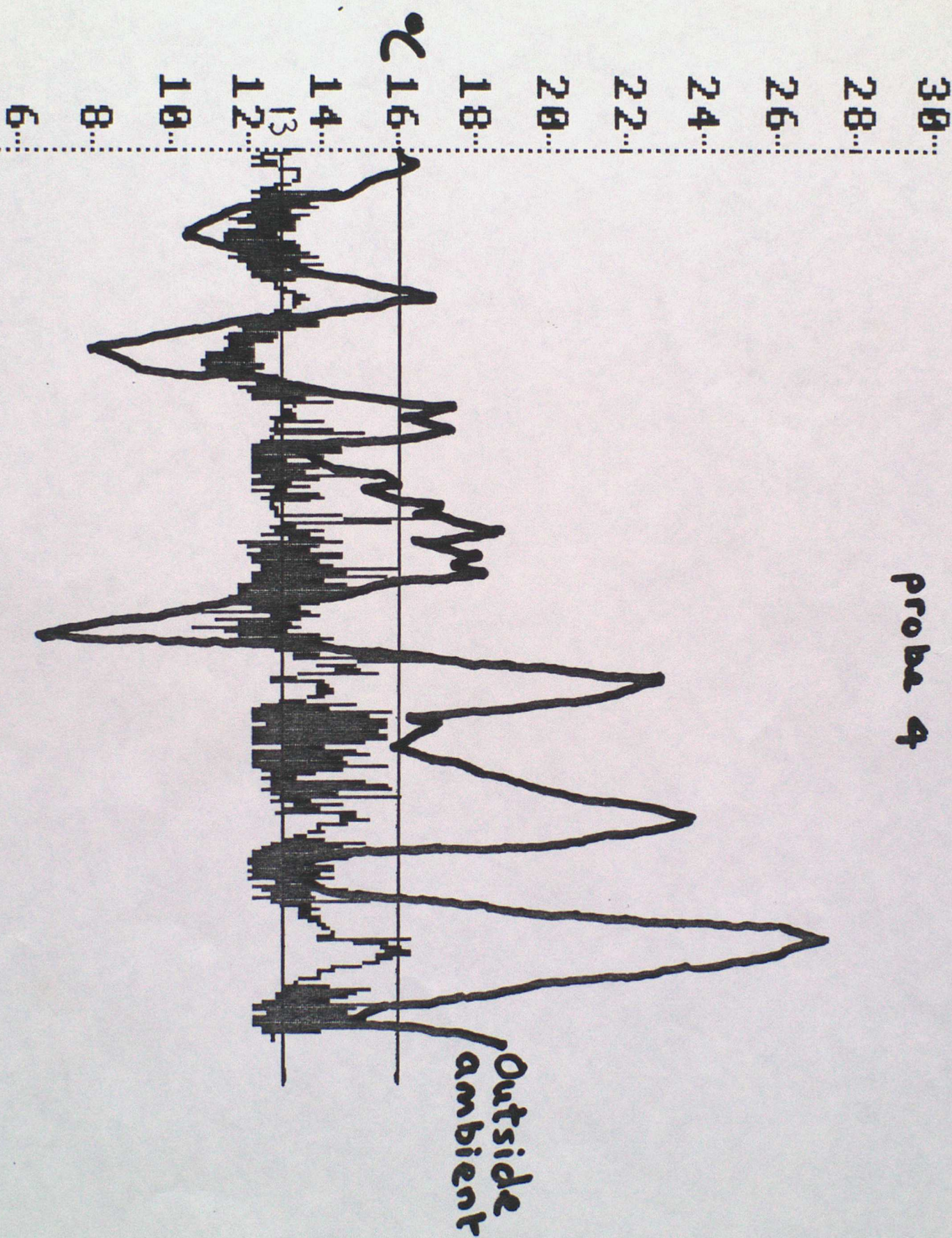
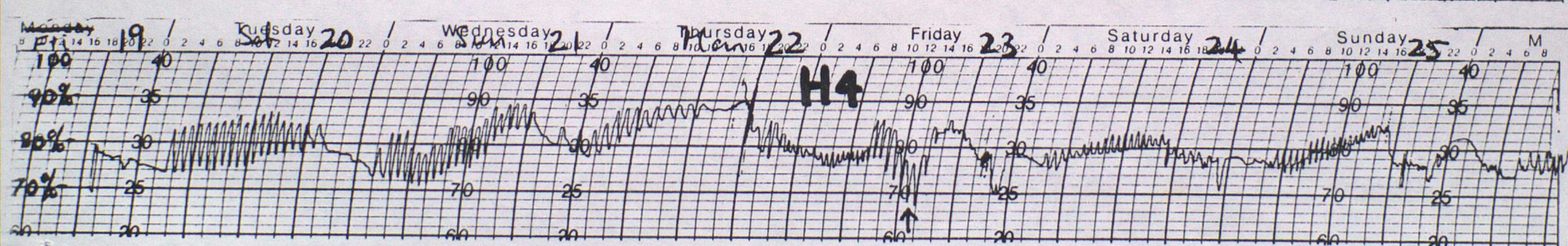
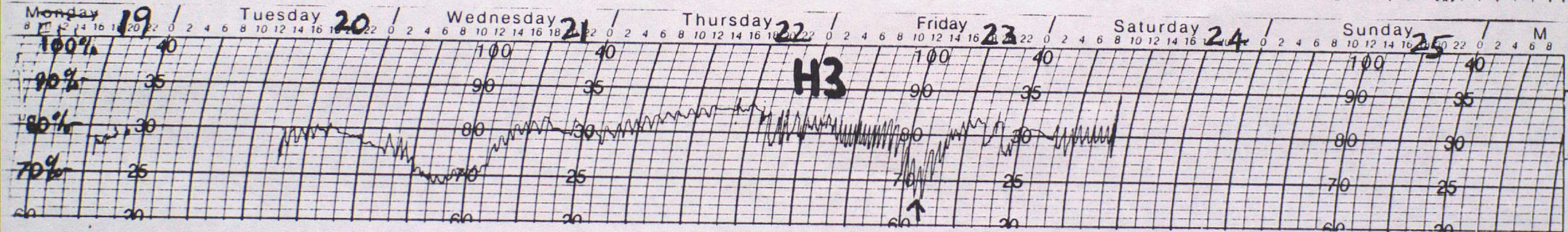
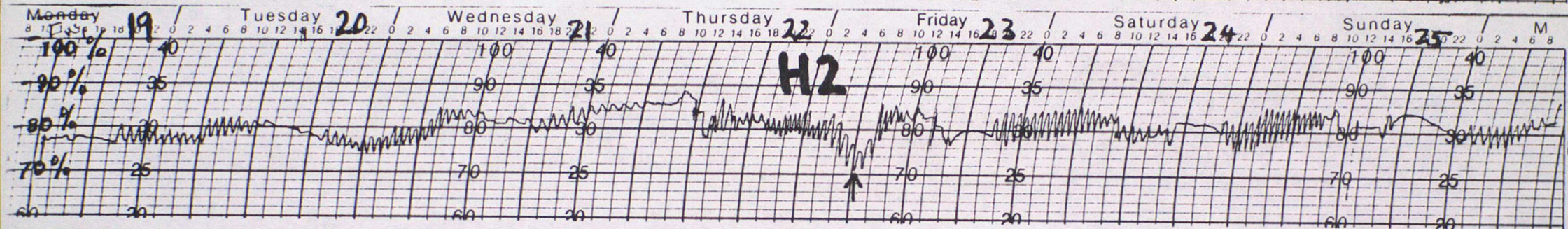
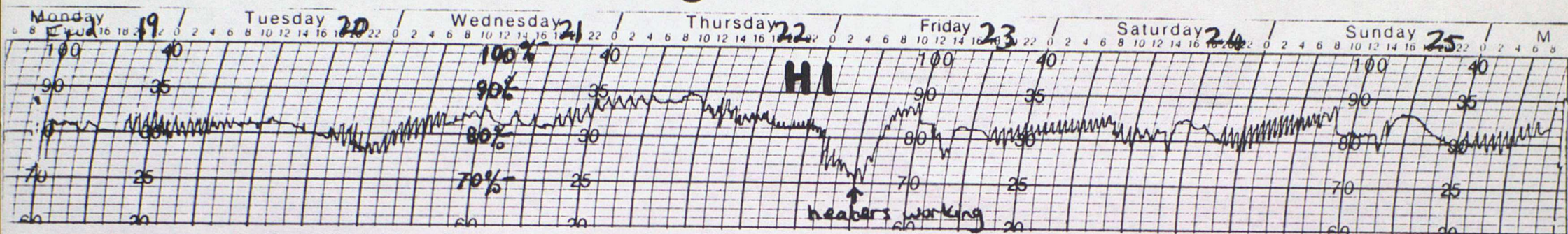


Fig 82



Note: Charts H3 & H4 were started 7 hrs later than charts H1 & H2. Therefore subtract 7 hrs to get correct line.